Canada's Forest Heritage

Because Canada is so vast, and its forests so diverse, forestry practices differ from province to province. This booklet is an overview. Statistical data is from *Forestry Canada 1986.*

Canadian Council of Forest Ministers
Conseil canadien des ministres des forêts

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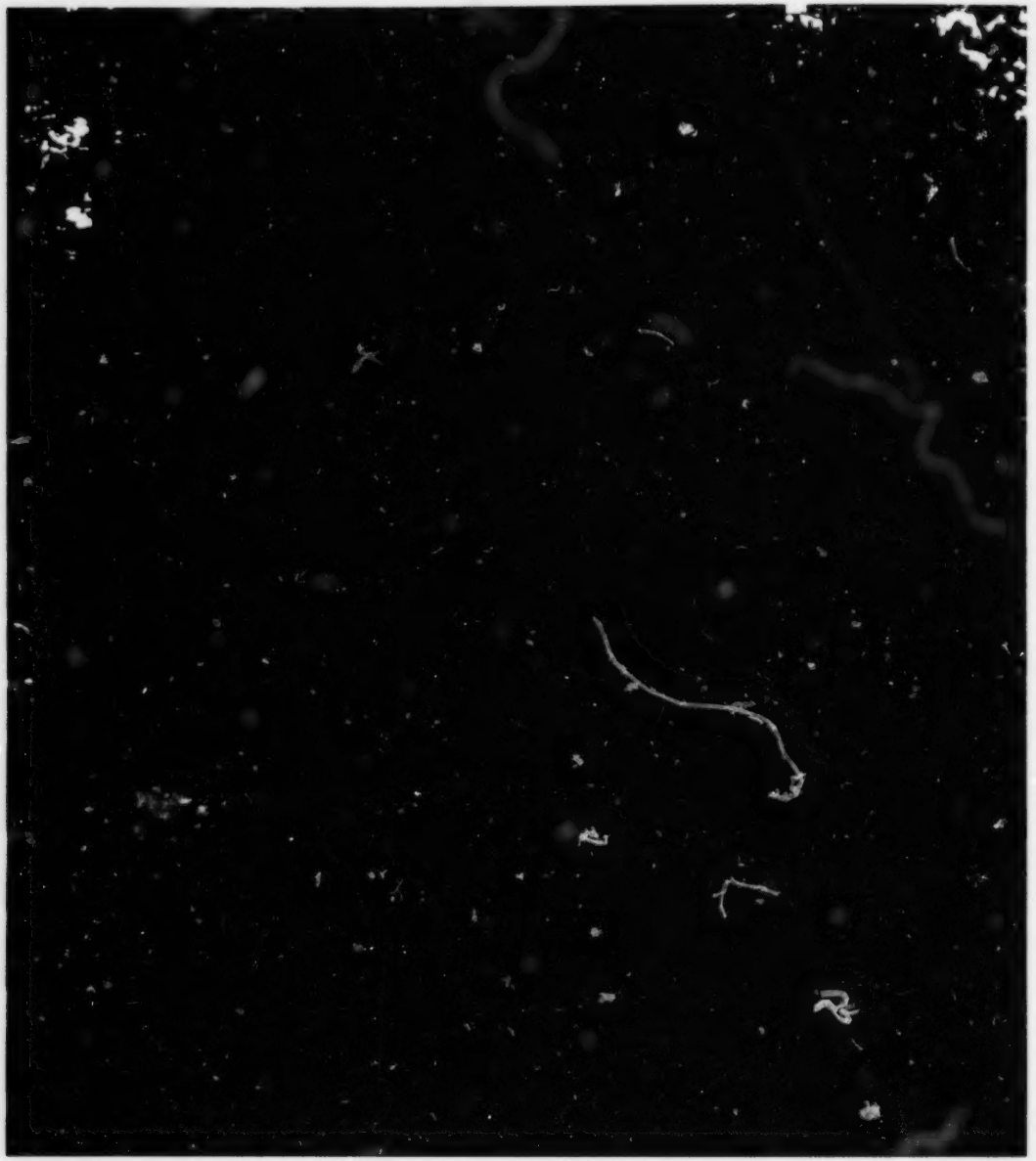

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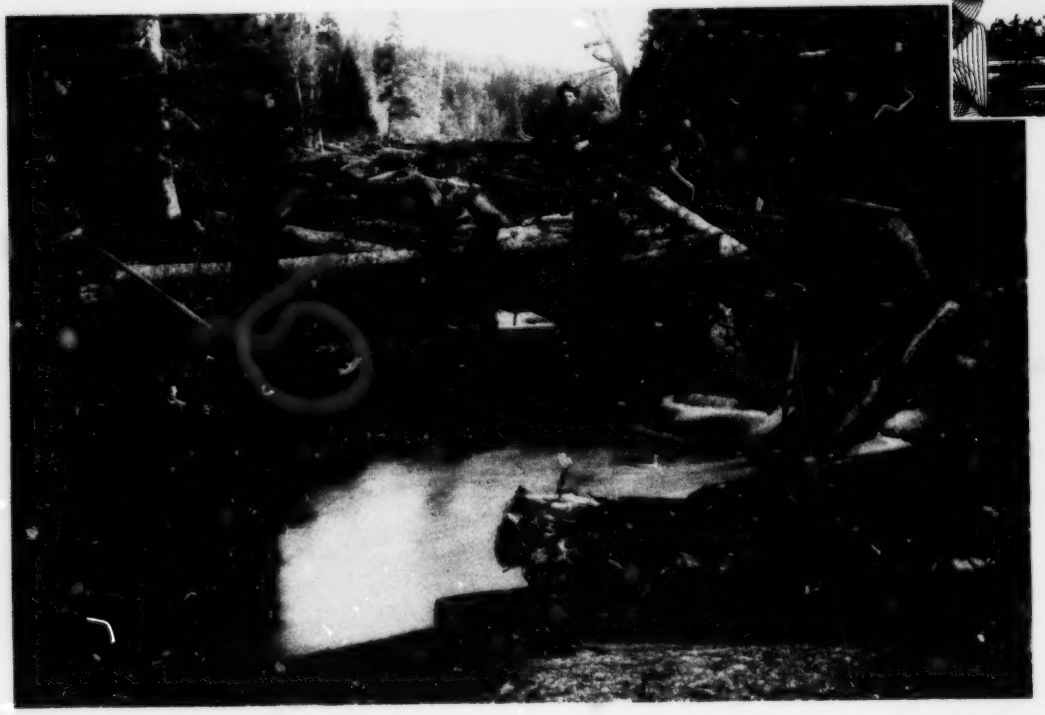
Canada
A Forest Country

Canada is recognized throughout the world as a forest nation. The forest industry is vital to our economy and, directly or indirectly, creates seven per cent of all jobs in Canada. The directly related jobs are worth almost $8 billion in total salaries.

Let's forget for a moment those bare, though significant, statistics. Look at the money in your wallet: trees appear on nearly every one of the paper bills. The national flag shows a maple leaf. Canadian artists from Emily Carr in the west to Gerald Squires in the east have captured trees on canvas. Reproductions of the paintings appear in corporate boardrooms across the country. Even people living in major urban centres like Montreal or Vancouver cannot help but sense forests as an ever-present backdrop to the Canadian scene.

Trees in fact underlie our national consciousness and identity. Balsam firs creaking after a snowstorm, a silent forest lake at dawn — who in Canada has not experienced these at least once? Living in a land with vast reaches of sparsely populated forest wilderness shapes our character more than most Canadians realize.



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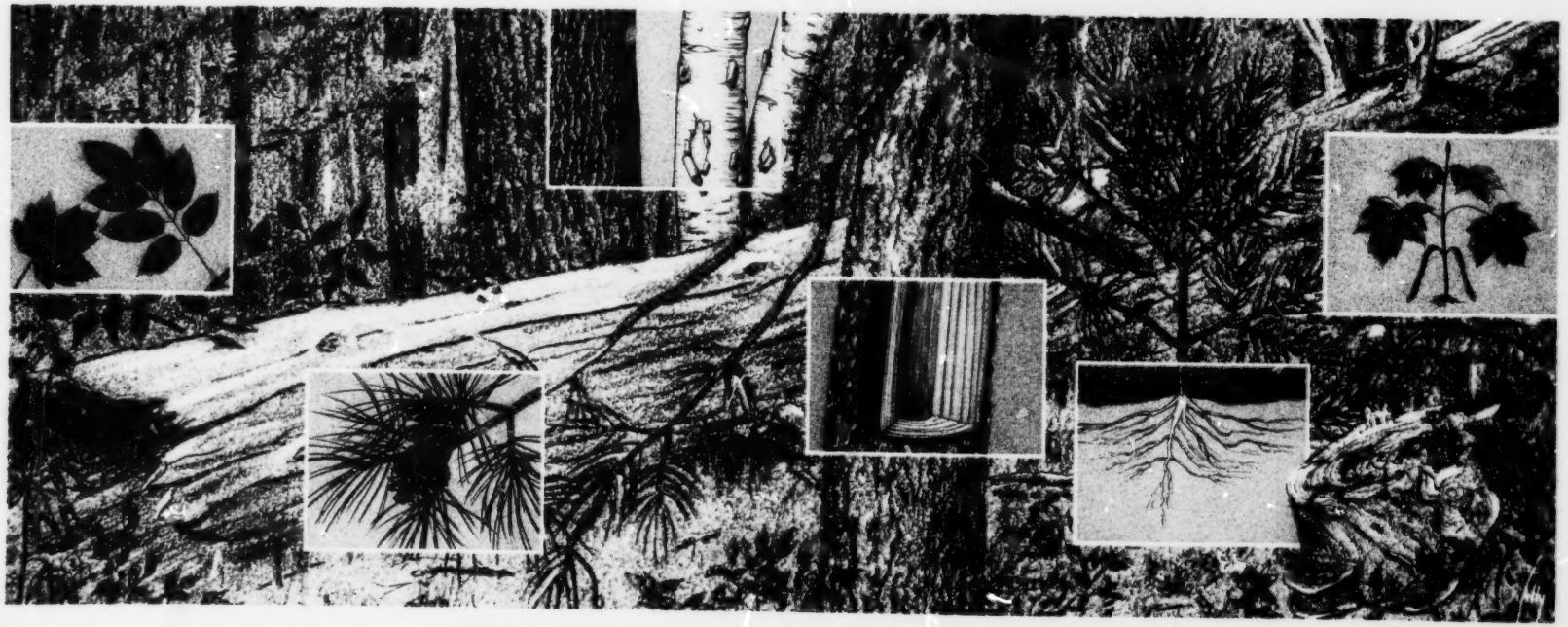
The Living Tree

Trees are complex organisms that live, breathe, reproduce and die. Several of their processes remain a mystery. We are still uncertain of precisely how leaves produce food, or of the exact means by which tall trees move fluids up the height of their trunks.

A tree comprises three main sections: the crown, the trunk and the roots. Roots have several functions. They anchor the tree in the ground, preventing it from toppling over during storms. As well, minute root hairs extract nutrients from the soil. The trunk acts as a two-way transport system. It simultaneously conducts nutrients up from the roots to the crown of leaves (or needles), and moves foods produced by the leaves back down to the tree's base.

Leaves or needles on a tree contain chlorophyll, a green pigment that closely resembles the haemoglobin in blood. Chlorophyll absorbs energy from sunlight and converts it into starches and sugars through what is perhaps the most magical of all natural phenomena: photosynthesis.

While performing these various life processes, trees respond to their environment in remarkable ways, as can be seen through time lapse photography. Leaves rotate daily following the sun's course, and seedlings have been shown to gradually displace large stones as they grow upwards. The force of life is powerful indeed.



The Forest Community

Trees are part of that complex and ever changing entity: the forest ecosystem. Without them, the natural world would cease to function properly. From its leafed or needled crown to its rooted tips, the tree is a pivotal life form around which the forest ecosystem revolves.

The forest community is a living, interrelated system. Trees shelter wildlife, and protect soil and water against wind and temperature extremes. Deer browse on leaves and twigs. Earthworms and other soil creatures digest fallen leaves and decaying plant and animal matter on the forest floor. Insects eat plant juices and leaves, later becoming food themselves for insectivorous birds and mammals.

When plants and animals die, their decay is hastened by the action of micro-organisms: bacteria and fungi, which break down organic tissue into nutrients to be absorbed and recycled by tree and plant roots. Tree roots help to anchor soil against erosion. They also enter bedrock fissures and wedge the rock apart to aid its slow disintegration into soil.

Like people, trees have defined life spans. A tree begins by germinating from a seed dropped to the forest floor. If the seedling survives, it grows into a mature tree. The mature tree that remains unharvested, or is not killed by disease, fire or insect damage, eventually becomes overmature. Its trunk deteriorates. Finally, the tree dies and collapses to the forest floor.

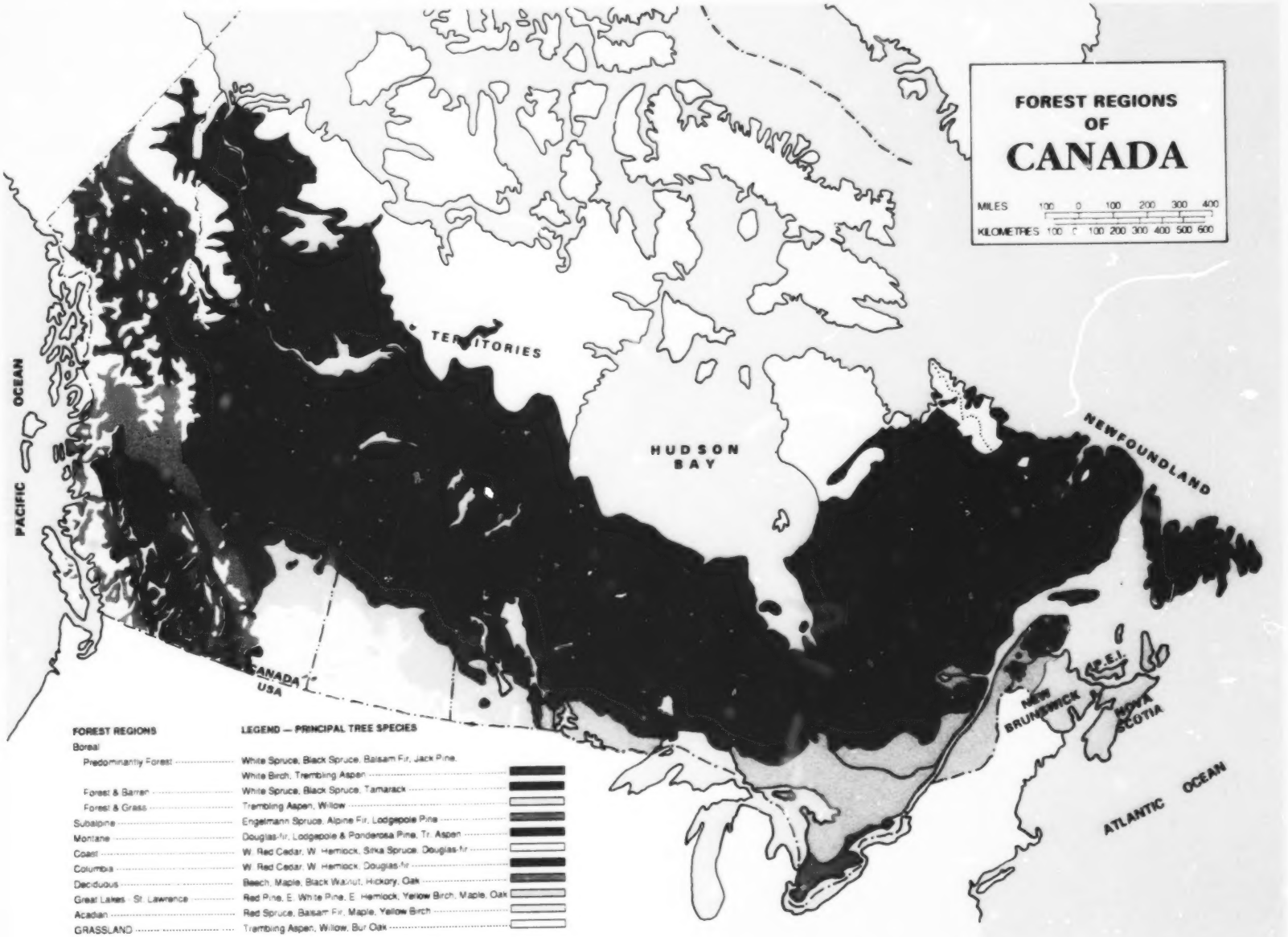
Yet even in death, a tree serves life. Bears pull its rotting trunk apart to find ants while other animals use it for shelter. Nearby saplings or immature trees can absorb nutrients released to the soil by the decaying tree. Thus nature continues the endless cycle of birth, life, death and rebirth.

Forests and the Ice Age

Canada was not always richly forested. Somewhere between 70,000 and 100,000 years ago, a decrease in the solar radiation reaching earth caused its climate to alter. Mean annual temperatures dropped, and winter snows ceased melting in the spring. Successive snow layers packed together until a massive ice sheet began to spread southward. The most recent ice age — the Wisconsin Epoch — overtook the land.

For many thousands of years, thick glaciers turned most of Canada into an icy and windswept country resembling present-day Antarctica. As ice advanced, forests receded. Glaciers reworked the landscape by shifting soil, transporting boulders and scouring bedrock. Remnants of the glaciers still remain on remote mountain peaks in Labrador, the Rocky Mountains and northwest Canada.

Between 12,000 and 13,000 years ago, improved atmospheric conditions brought the ice age to an end. Plant and tree seeds arrived from southern unglaciated regions and gradually took root. Within a few thousand years, much of the barren wasteland was transformed back into forested terrain.


FOREST REGIONS
OF
CANADA
MILES 100 0 100 200 300 400
KILOMETRES 100 0 100 200 300 400 500 600
TERRITORIES
HUDSON BAY
PACIFIC OCEAN
NEWFOUNDLAND
P.E.I.
NEW BRUNSWICK
NOVA SCOTIA
ATLANTIC OCEAN
CANADA
USA
FOREST REGIONS
LEGEND — PRINCIPAL TREE SPECIES
Boreal
Predominantly Forest — White Spruce, Black Spruce, Balsam Fir, Jack Pine, White Birch, Trembling Aspen
Forest & Barren — White Spruce, Black Spruce, Tamarack
Forest & Grass — Trembling Aspen, Willow
Subalpine — Engelmann Spruce, Alpine Fir, Lodgepole Pine
Montane — Douglas-fir, Lodgepole & Ponderosa Pine, Tr. Aspen
Coast — W. Red Cedar, W. Hemlock, Sitka Spruce, Douglas-fir
Columbia — W. Red Cedar, W. Hemlock, Douglas-fir
Deciduous — Beech, Maple, Black Walnut, Hickory, Oak
Great Lakes - St. Lawrence — Red Pine, E. White Pine, E. Hemlock, Yellow Birch, Maple, Oak
Acadian — Red Spruce, Balsam Fir, Maple, Yellow Birch
GRASSLAND — Trembling Aspen, Willow, Bur Oak

c. 7-8000 years ago

Forest cover gradually regenerates over most of Canada following the ice age. Trees are used by native people as a source of food, heat, boat and home building material.

1604

Samuel de Champlain establishes one of the earliest European settlements in Canada, on an island in the Saint Croix river.

c. 1650-1700

First sawmills appear along the St. Lawrence River and in Atlantic Canada.

1763

American Revolution restricts British access to New England timber supply. Britain begins to exploit Atlantic Canada forests for masts and spars.

1793-early 1800s

Napoleonic Wars restrict British access to Baltic timber. This initiates Canada's timber trade with Britain, an industry that continues to grow throughout the 19th century.

1848

U.S. timber merchants and lumbermen begin setting up business in Canada, building mills and importing American workers. By the end of the century, the value of American lumber trade equals that of Britain.

First sawmills appear on Vancouver Island, just outside of Victoria.

Some Historical Highlights of Canadian Forestry

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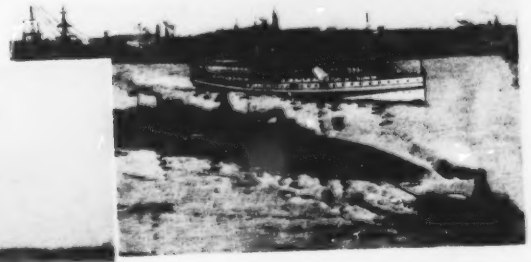

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1860s

Lumber exports begin from western Canada, mainly to South America, Australia and San Francisco.

1866

First Canadian groundwood pulp mill opens in Valleyfield, Quebec.

1869

First Canadian chemical pulp mill opens in Windsor Mills, Quebec.

1899

Elihu Stewart, first Dominion Forester, is hired.

c.1914-1939

East coast lumber industry declines. The best timber is depleted, and Britain re-establishes links with Baltic lumber merchants.

Protectionist Acts passed by U.S. government close the American market to Canadian timber.

West coast forest industry gradually expands to comprise half of the total Canadian lumber production.

after 1939

Both lumber and pulp and paper exports grow steadily from the Second World War to the present day.

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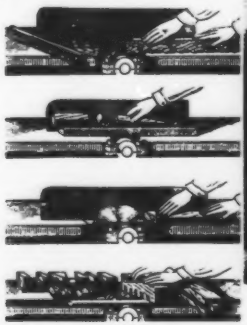

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A New Vision

The early pioneers who reached North America were greeted by indigenous tribes living in close harmony with their natural surroundings. Yet to most Europeans, the forests appeared as an impenetrable barrier of trees.

Even though the pioneers lost their fear of the forests, they considered them to be inexhaustible. Logging bees were held to clear acres of virgin timber overnight, freeing the land for crops to feed family and cattle. Wood was used for everything from tools and furniture to water buckets and sewer collectors. Settlers burned it for fuelwood, charcoal and potash production. Still, most of the felled trees were simply tossed onto huge bonfires .

Equally shortsighted was the widespread harvest of tall pines for ship masts and spars in the early 19th century. Britain, for example, imported 16,729 pine masts from British North America in a single year. Little wonder that the prime white pine stands of eastern Canada dwindled within decades.

Canada's first prime minister, Sir John A. MacDonald, warned: "We are recklessly destroying the timber of Canada, and there is scarcely the possibility of replacing it." That was in 1871. For almost another century, Canadians continued to take the forests for granted, depleting their precious natural inheritance. They did so, because they could get away with it.

Today, however, conditions have changed dramatically. We no longer take our forests for granted. Tree harvesting has greatly increased, due to rising world requirements for forest products. Meanwhile, forest lands are being set aside for watershed protection, wilderness and ecological reserves. The forests no longer appear inexhaustible.

Canada's attitude towards forestry, like the country itself, is maturing. We are learning to see the forest ecosystem as a dynamic, interlocking process rather than a static thing. Trees affect the air we breathe, and the water we drink. They ensure the continuation of life on earth, including that of mankind itself.

The forest is a renewable resource; renewable, however, does not mean indestructible. Long-term forest management is therefore integral to provincial resource planning. "Nature, to be commanded, must be obeyed." Francis Bacon's words are more pertinent now than ever before. Our challenge is to work within nature's laws while commanding its strengths. Only then will there be a healthy forest for Canada's future.

Forest Management

Forest management in Canada is based on two complementary principles: sustained yield and multiple use. Sustained yield dictates that the volume of each year's wood harvest not exceed the annual yield. The concept of multiple use requires forests to function as more than a source of industrial wood; they also must serve recreational and — equally important — environmental needs.

Forest management is complex, due in part to the long growing cycle of trees. Most tree species require at least 40 to 80 years for a stand of seedlings to become a harvestable crop. During that rotation period, trees can be damaged or lost to disease, fire, insects and wind.

Changing economic and social conditions also affect forest planning. The recent increase in world timber demand, for example, has forced planners to devise means of actually increasing (not just sustaining) the volume of wood harvested from Canada's forest. This challenging goal is achievable only through intensive forest management.

The forest management cycle involves five major activities: planning, silviculture, protection, harvesting and research. Managing the forests through thinning natural stands, planting, and protecting all forestland can assist trees to grow faster. Scientific research, in turn, helps to develop better means of achieving forest management goals.

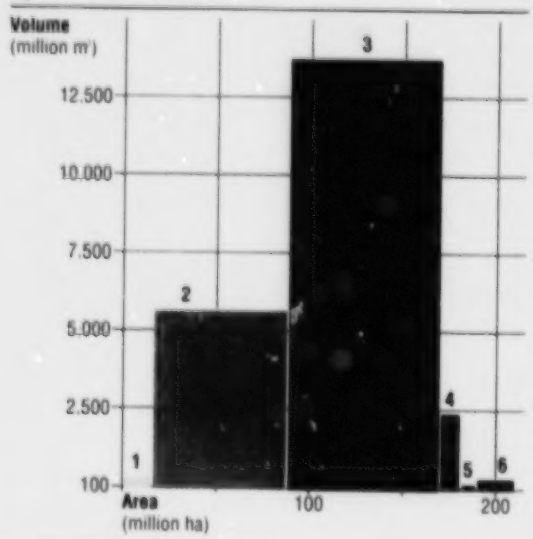
Before long, we will be able to harvest far greater volumes of wood per hectare than we do currently. Meanwhile, we must use today's resources efficiently.

Planning Our Forestry Future

Planning is fundamental to the forest management cycle. Yet planning is only as accurate as the information on which it is based. Thus, inventory and mapping of Canada's forest lands is an ongoing process. A new computer technology called the Geographic Information System (GIS) assists planners in compiling accurate, updated forestry data.

The Canadian forest inventory includes information on the size, age, ownership, wood volume and species composition of our forests. The charts and diagrams shown over the next few pages illustrate the current status of our forests.

Age of Productive Forest Lands by Area and Volume



Caption:
Much of the volume of our merchantable timber lies in mature stands (40 to 60 years old) that are ready for harvesting now. However, they must be managed so as to supply the forest industry for another two or three decades until the present regenerating and immature forest stands become mature.

Ideally, trees in a managed forest are evenly distributed by age and area: thus, each age group covers approximately equal areas of the forest land, thereby ensuring continuous supply of wood. Canada is in a transitional stage, moving from a wild forest to a managed one. Presently, we have too little regenerating stock and too much immature and mature stock, by area.

Canada's Land Classes

Total Area: 9.97 Million km² (1986 figures)

Water 7.5%

Non-forested Land
54.5%

Forest Land
45.5%
(4.53 km²)

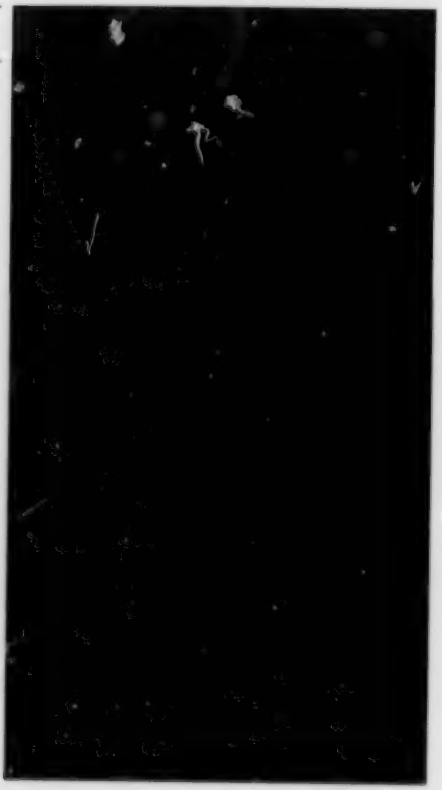
Non-productive Forest Land
13.5%

Productive Forest Land
24.5%

Hardwood Forest Cover
14 % of Productive Forest

Mixedwood Forest Cover
23% of Productive Forest

Softwood Forest Cover
63% of Productive Forest

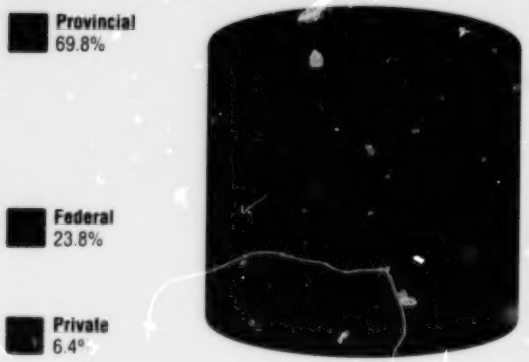


Caption:
Canada's forest covers about 4.5 million square kilometres, larger than the entire landmass of Eastern and Western Europe. About two thirds of the area is productive forest land, suitable for regular harvesting.

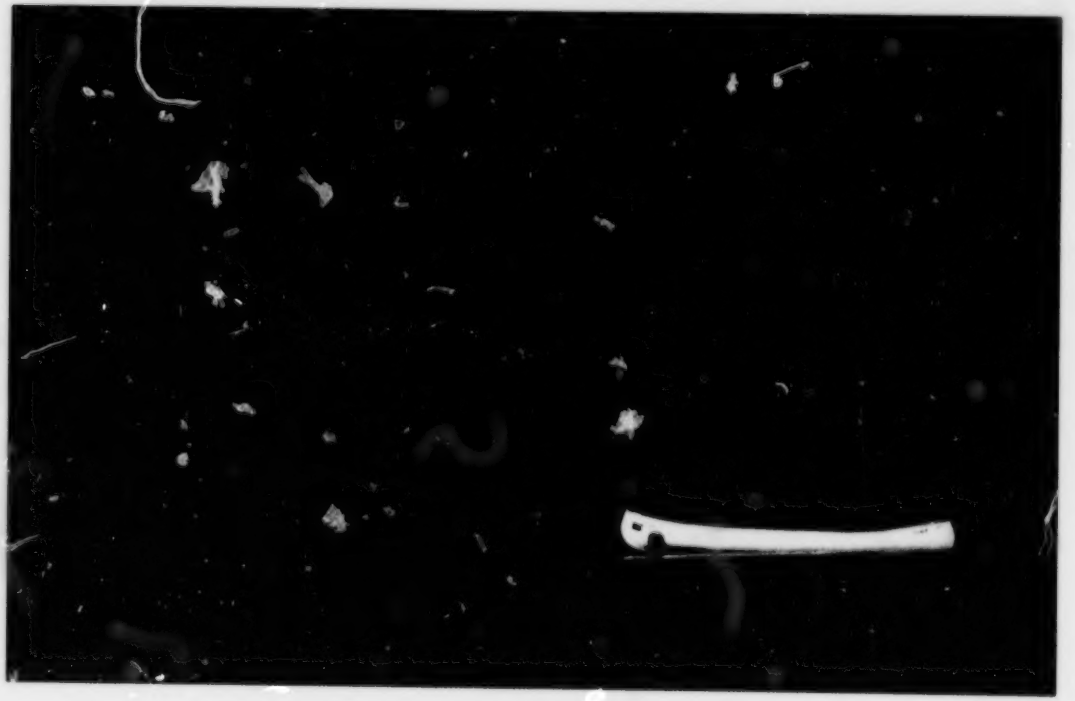
Coniferous species dominate the forest cover. Mixedwood stands (containing approximately equal volumes of hardwood and softwood species) and hardwood stands are less prevalent.

Ownership of Canada's Inventoried Forests

Total Area: 3.98 million ha

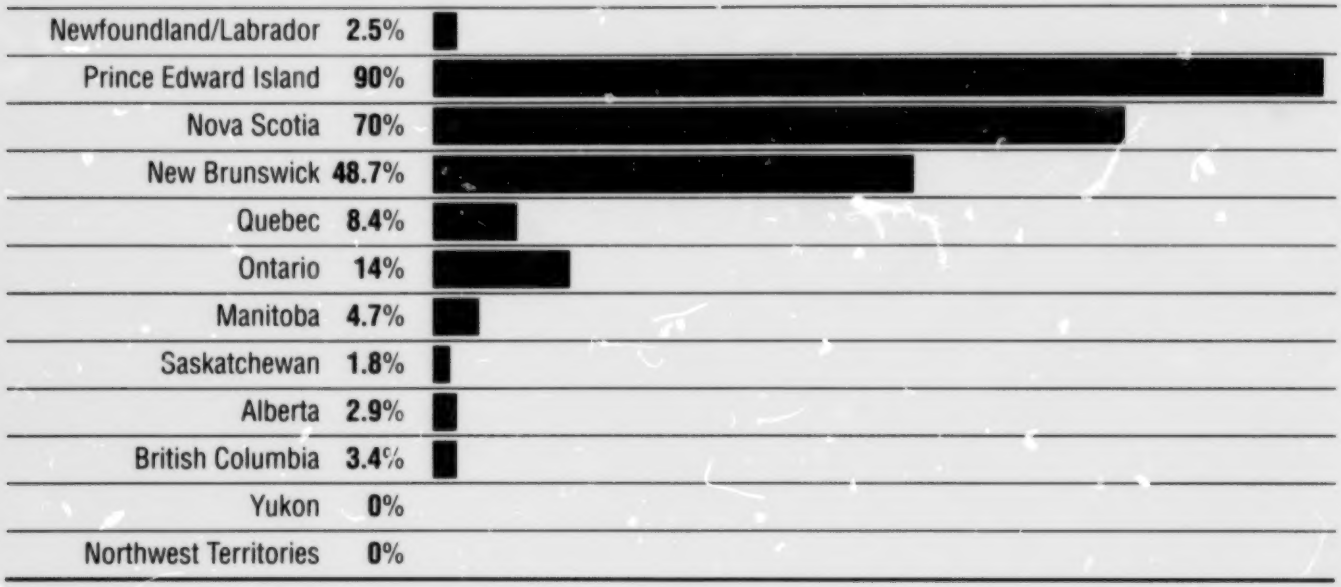


Caption:
Ownership of Canada's productive forest lands is divided between the provincial government, the federal government, and private individuals and companies. By far the largest proportion is publicly owned and administered by the provinces as Crown Land. In most instances, companies have agreements with the provinces for the right to harvest, and the obligation to manage, areas of Crown Land.



Private Ownership of Inventoried Forest Land by Province

Private forest land as percentage of total inventoried forest land in province.



Caption:
Although only about six per cent of Canada's productive forest land is privately owned, the relative proportion of private holdings varies widely between provinces. Included among the private owners are some 425,000 private woodlot owners, many of whom actively work the forest.

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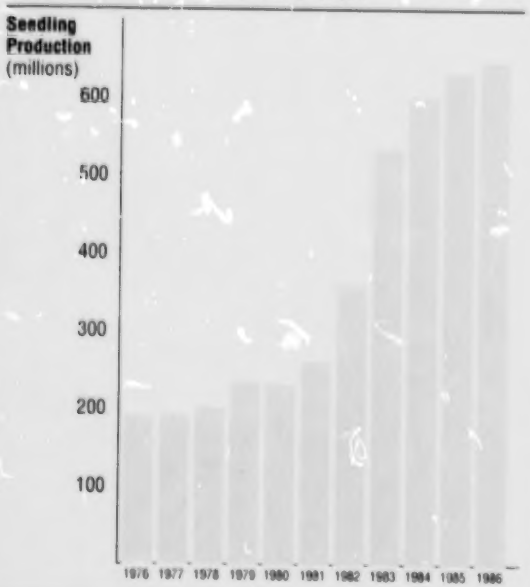
Tree Seedling Production in Canadian Nurseries: 1976-1986



Caption:
Annual seedling production for forest regeneration has risen steadily within the last decade, almost doubling between 1980 and 1984. In the same time period, overall silviculture expenditures, made by industry and government together, have gone up by about seven per cent annually.

Silviculture in Action

Silviculture is the science of growing, tending and regenerating trees. The word derives from Silvanus, an ancient spirit of forests and fields. Today's silvicultural practices work to regenerate preferred tree species, accelerate their growth rate, and establish a healthy, harvestable forest in as short a time as possible.

After an area has been harvested, the regeneration of new trees begins. Natural regeneration relies on trees growing in the wild as a seed source, and succeeds where adequate soil, species, site preparation and climatic conditions prevail.

Nature's way of rebuilding forests does not always fit the timetable of an industrial society. Where natural regeneration is insufficient or produces commercially undesirable species, tree seeds or seedlings are planted. This practice is known as artificial regeneration.

Tree seeds can be dispersed directly by aircraft or from the ground, where conditions are favourable. However, many harvested areas regenerate more successfully when stocked with tree seedlings that are produced in nurseries, and then transplanted.

Seedling Production

Each year, more than half a billion tree seedlings are grown in nurseries across Canada. The provincial governments operate some nurseries; private industry owns others. Seedlings from government nurseries are planted on Crown Land, and also are available for use on private holdings in many provinces. Seedlings from private nurseries are planted on private and Crown Land.

Increasingly, foresters select cones from genetically superior 'plus trees'. ('Plus trees', although not common, are tall, straight, and grow fast — characteristics desired by the forest industry.) The cones are then dried, and the seeds extracted and stored for future use.

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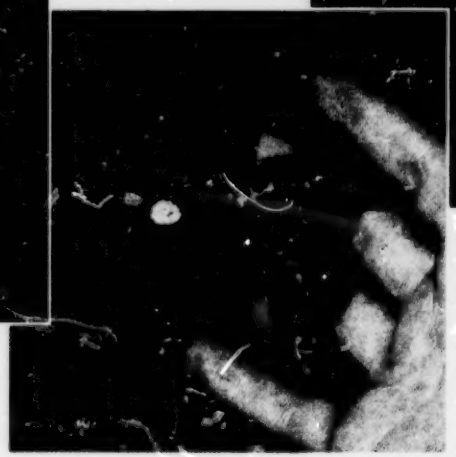

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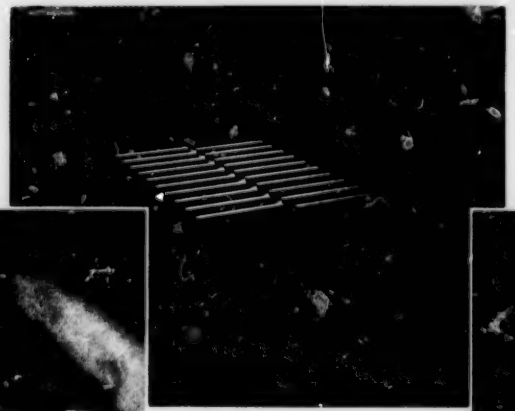

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Almost all seedling production is of softwood species. Two kinds of tree seedlings are grown for forest regeneration: bare-root and container. Bareroot seedlings grow outside from seed sown in seed beds. After two to four years, seedlings are uprooted, packed and shipped to the forest to be planted.

Container seedlings grow in greenhouses from seed placed in specially designed plastic or paper containers filled with a peat-soil mixture. Before planting, seedlings are stored out-of-doors to become acclimatized. One to three crops a year can be produced in a greenhouse.

Container seedlings are quicker to produce, and easier to handle and plant than the bareroot variety. Because the roots remain undisturbed, the success rate is high. In some parts of Canada, since bareroot seedlings are larger, they can better compete with surrounding vegetation. However, in British Columbia, container stock out-performs bareroot.

Planting

Tree seedlings from nurseries are usually planted by hand. Mechanized hand tools such as the pottiputki are used on some plantation sites across Canada. They enable workers to plant up to 1500 seedlings per day. Black and white spruce, and balsam fir are the most common species placed on regeneration sites.

Site Preparation

Before regeneration can occur effectively, the harvested site may have to be prepared to ensure the successful growth of the new crop. Scarification by mechanical equipment breaks up logging debris and exposes the mineral soil. Another technique involves prescribed burning, which rids the ground of leftover brush. Chemical site preparation, too, can be used to reduce competing vegetation and allow young trees to become established.

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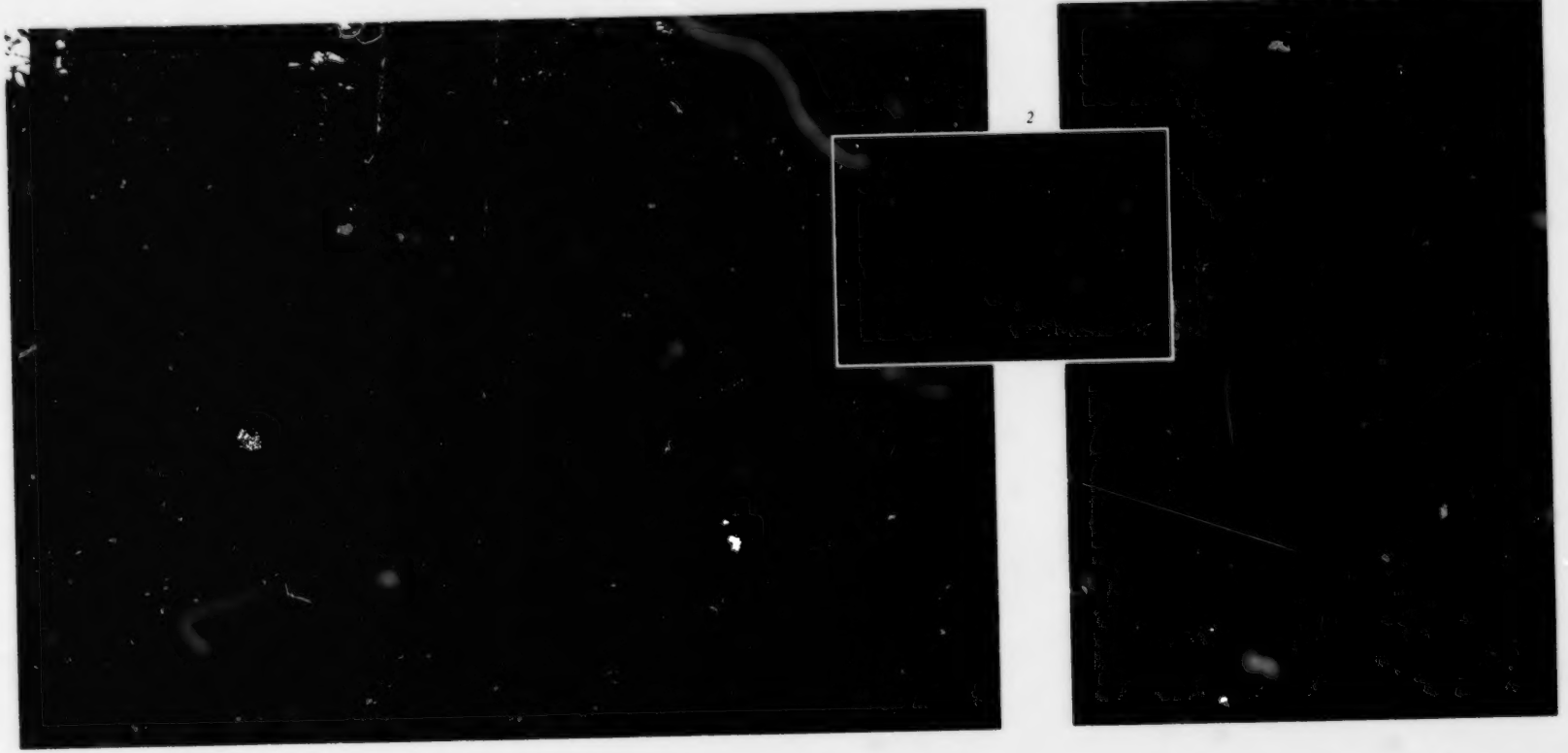
Treatments

Pre-harvesting treatments are the means by which regenerating seedlings are encouraged to grow more quickly into a healthy forest. They improve the quality of a forest stand and accelerate its natural growth. The trees can be harvested within a shorter time, thus allowing the forest industry to obtain a larger volume of wood per hectare over several rotations.

In some provinces, chemical weeding is carried out to suppress unwanted vegetation on both natural and artificial regeneration sites.

When naturally regenerated trees reach a height of two to three metres, forest workers thin the area, making sure to remove unhealthy or misshapen trees. This initial or juvenile spacing somewhat resembles thinning a row of carrots, leaving fewer trees per hectare. The remaining vigorous trees receive more light and nutrients, and have ample room to grow to sawlog size. A later, commercially profitable thinning may occur before the trees mature for the final harvest.



Forest Protection

Every year, the combined losses from fire, insects and disease destroy or weaken more timber than is harvested. One reason is that mature and overmature stands — which by volume are the predominant ages of Canada's forests — are particularly susceptible to insects and disease. Large areas of even-aged, single-species forests also tend to suffer severely during insect infestations.

These timber losses seriously diminish our already limited industrial wood supply. Furthermore, millions of dollars are spent annually on fire fighting alone — money that could go to support forest research or reforestation work. Forest protection, therefore, is part of the commitment to forest management.

Forest Fires

People and lightning cause nearly all forest fires. Traditional fire lookout towers, aerial patrols, and computerized equipment are important in early fire detection. Once spotted, a fire is extinguished by the most suitable means available. This can range from ground crews digging trenches and spraying water from portable water tanks to aircraft dropping water and chemical fire retardants.

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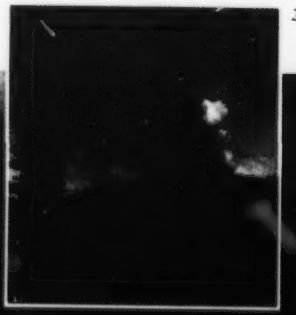

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Insects

Insects wreak tremendous havoc on Canada's forests. Spruce budworm, mountain pine beetle, spruce bark beetle and other insects can defoliate trees, attack cones, buds and nursery stock. They annually ravage an amount of wood equal to nearly one third of the volume harvested.

Infestations are natural in the forest cycle. As with many creatures, insect numbers rise and fall regularly. When infestations become epidemic, however, forest managers must take steps to limit further timber losses.

Insect control techniques differ across Canada. Some provinces spray government-approved insecticides, including bacterial formulations, aerially. Another means of reducing insect populations is to accelerate the harvesting of vulnerable tree species. Removing a swath of trees wide enough to act as a natural insect barrier (sanitation harvest) also works well in areas of localized infestation.

Because these methods have variable success rates, research projects are ongoing to develop alternative methods of insect control.

Disease

Tree diseases are harder to detect and to control than fire and insect damage. Dutch elm disease, dwarf mistletoe, rusts, cankers and fungi are among the more well known afflictions. Chemical applications and sanitation harvesting have proven effective in some instances.

Given society's demands, there is no doubt that intensive forest protection is required. Nonetheless, we should not forget that fire, insect attacks and disease play important roles in the forest renewal process. The forester's task is to approximate the natural system in a manner that is both industrially and environmentally acceptable.

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Harvesting the Forest

Harvesting is one stage in the forest management cycle. Few people would maintain that newly harvested terrain is visually pleasing. Yet without tree harvesting, Canada's economy and standard of living would quite simply collapse. One only has to glance around one's home to realize how wood and forest products enter every facet of daily life.

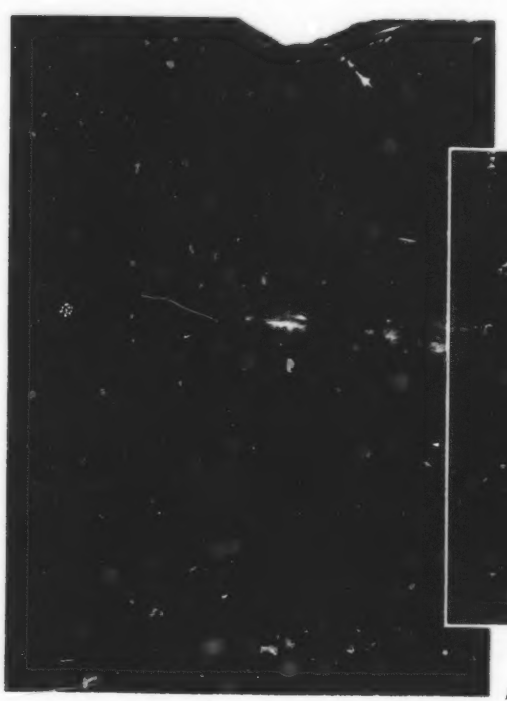
Harvesting Methods

Clearcutting, shelterwood cutting and selection cutting are the three main harvesting methods. Whatever method is used, the individuals or companies involved are required to follow strict provincial regulations. These include size of the harvested area, proximity to streams and rivers, wildlife habitat protection, and the effect on recreational areas.

Clearcutting removes all trees from an area at once. It yields timber rapidly and economically, and is the predominant method practiced in Canada today. Clearcuts often regenerate into even-aged forest stands.

The shelterwood method is a variation of the clearcut. Here, a partial cut in an area preserves quality mature trees to provide seed and protection for natural regeneration. Only after the young seedlings become established are the mature trees harvested to produce an even-aged forest stand.

In selection cutting, individual or small groups of trees are periodically selected for harvest. The forest cover is never fully removed, and uneven-aged stands result.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Harvesting Systems

Tree length is the main system used in Canada. Trees are felled, the branches and tops are removed, and the stem is transported to roadside. There, workers cut tree stems to log lengths and pulp lenghts. For the shortwood systems, these lengths are cut when the tree is felled.

Highly mechanized harvesting systems cannot be used in areas that are environmentally sensitive or have rough terrain.

Scientific research has enabled the forest industry to turn what once was considered waste material into commercial products.

Many companies recycle mill leftovers – bark, edge trims, split lumber and so on – back through their own woodchip-fired heating units, thus reducing fuel costs. Chipped mill residue also can be fed into pulp vats. Bark and sawdust can replace oil in converted electrical generating plants. Bark chips make good horticultural mulch, and wood shavings can be manufactured into waferboard. Previously discarded mill trim can become fingerjointed lumber — the list goes on.

Minimizing wood waste is an important part of the overall management strategy that seeks to make better use of Canada's forest wealth.

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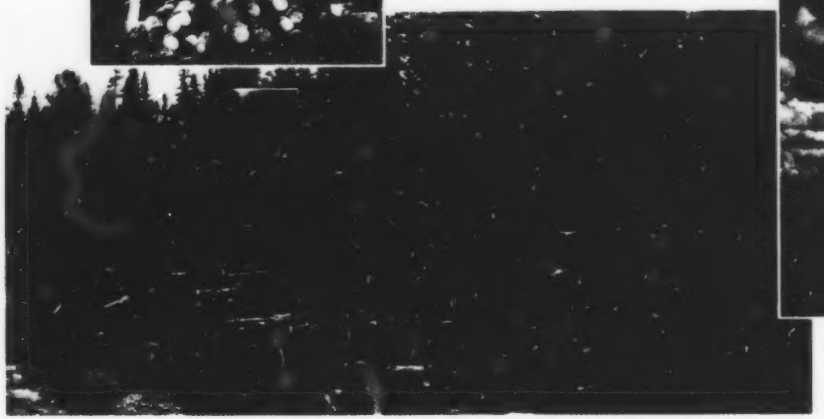

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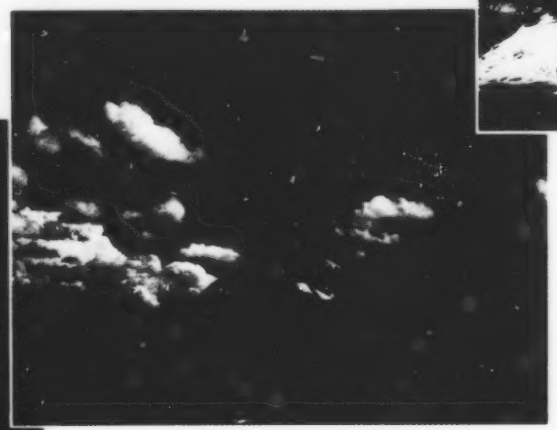

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4

The Productive Forest

If every moveable object made of wood or other forest products were shifted from a standard Canadian house, little would be left but the kitchen sink. Items such as paper towels, furniture, matches, magazines and cardboard boxes are commonly recognized as being made of wood or related products. Yet video tapes, rayon clothes, cleaning fluids and camera film, too, are among the things manufactured from wood-derived products.

Many of these goods are produced in Canada, and are responsible for making the forest industry the country's largest manufacturer. Primary and manufactured or secondary forest products worth almost $30 billion are shipped within Canada and exported around the world. Directly or indirectly, the industry creates seven per cent of all jobs in Canada.

Forest products can be separated into:

- wood products
- paper and related products
- pulp derivative chemical products
- maple syrup and Christmas trees.

Wood Products

The first Canadian sawmills began producing lumber in the late 1600s. Family run sawmills have traditionally sustained many rural communities. Today, softwood lumber is economically Canada's most significant wood product.

The shakes, shingles, plywood, particleboard, waferboard, veneer and furniture manufacturing sectors all have significant production values. Other Canadian wood products include railway ties, hydroelectric and telephone poles, crates, fencing, flooring, and mine timbers.

Specialty items give diversity and breadth to the forest industry. Peavey handles, chopsticks, wooden barrels and ice hockey sticks all are made in Canada. Master boat builders can be found on both coasts and inland. Skilled traditional woodworkers living across the country create wooden toys, sculptured bowls, musical instruments and other crafts.

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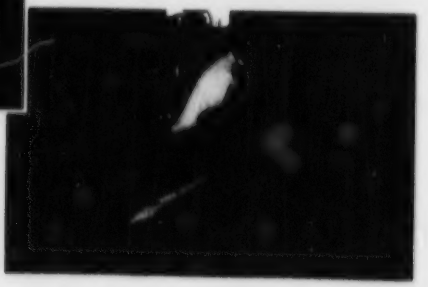

6

Another familiar wood product — fuelwood — is beginning to displace furnace oil in some regions of Canada. Fuelwood constitutes a substantial volume of primary wood production in several provinces. For the non oil-producing provinces, local fuelwood sales have an important feature. Money spent on fuelwood remains largely in-province, unlike most of the oil revenue.

Paper and Related Products

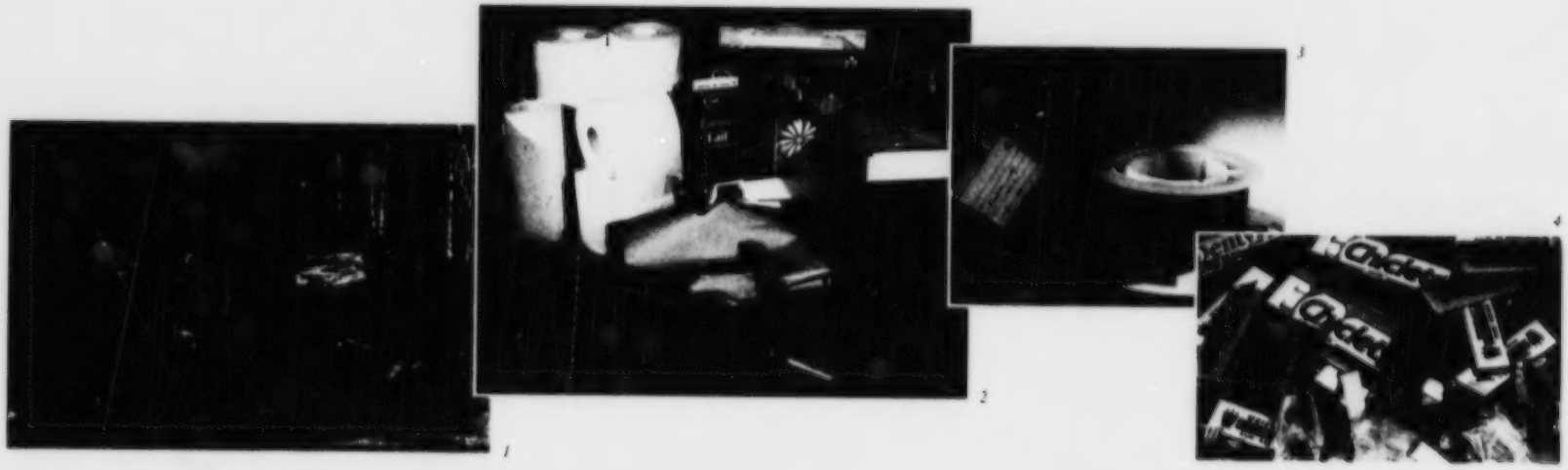
The basic paper-making phenomenon is so simple that it can be reproduced in a kitchen. Yet the pulp and paper industry supports Canada's most economically valuable forest product industry, worth about $7 billion in exports alone.

Wood consists in part of cellulose cells embedded in lignin, rather as coconut fibres are stuck in toffee. Freeing cellulose from lignin is required to produce paper and is accomplished either chemically or mechanically. Cellulose mixed with water and other ingredients forms pulp. As water is pressed from pulp, the wet fibres adhere to one another to create paper.

In paper mills across the country, sheets of pulp move at 60 kilometres an hour, 24 hours per day to become countless kilometres of newsprint, glossy magazine paper, boxboard and other paper stock. *Chatelaine* and *Reader's Digest* magazines, Q-Tips, VISA carbonizing tissue, McDonald's hamburger wrappers — these are just a few of the numerous paper and related items manufactured either domestically or abroad that began as Canadian trees.

Pulp Derivative Products

Some highly refined cellulose pulps are chemically converted into such products as cellophane, rayon, photographic film, plastics and explosives. Other mill by-products include turpentine and lignin. They can be manufactured into vanillin, alcohol, cement additives, cleaning fluids and scores of additional goods found in a typical Canadian household.



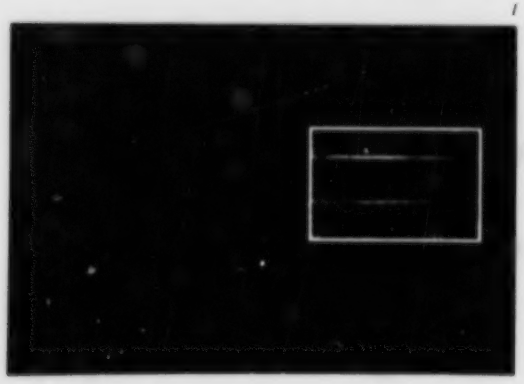
Other Forest Products

In some areas of Canada, maple sugar festivals have come almost to rival Christmas in festivity and tradition. Both rituals involve products that lie beyond the mainstream of the forest industry: maple syrup and Christmas trees. A pungent balsam fir bough or the smokey taste of fresh syrup evoke pleasant memories for many Canadians.

The balsam firs seen stacked on snowy parking lots in December actually yield the highest revenue per tree of any forest product. Like sugar maple stands, Christmas tree plantations require very intensive management. They usually are operated by small private woodlot owners who can commit the necessary time. Each year, Canada exports millions of balsam fir, Scots pine, Douglas-fir and white spruce to the United States, Caribbean, Bermuda and elsewhere.

Early white settlers learned from the Indians how to make maple syrup or 'sweet water'. They whittled wooden taps and collected sap in birch bark buckets. Today, most commercial sugar bush operators rely on interconnecting hoses and a central vacuum pump to extract the sugar-rich sap.

The sugar maple stands of Ontario, Quebec and the Maritimes are renowned for syrup production. Recently some of the stands have shown weakened conditions and fewer leaves. Since the leaves are needed to produce sap, a decline can be anticipated. The effect on the maple syrup industry is as yet uncertain.



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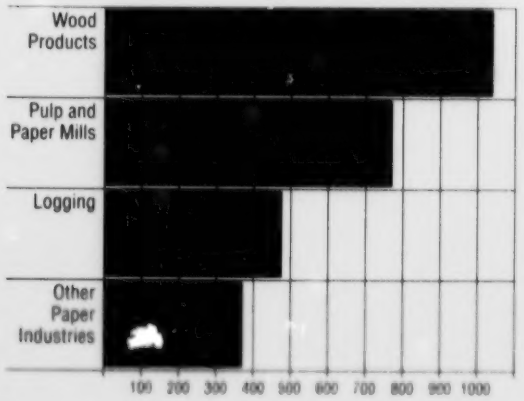
Employment in The Forest Industry

Total Number of Employees: 267,709 (1985 figures)


Wood Products
Pulp and Paper Mills
Logging
Other Paper Industries
100 200 300 400 500 600 700 800 900 1000
Number of Employees (in thousands)

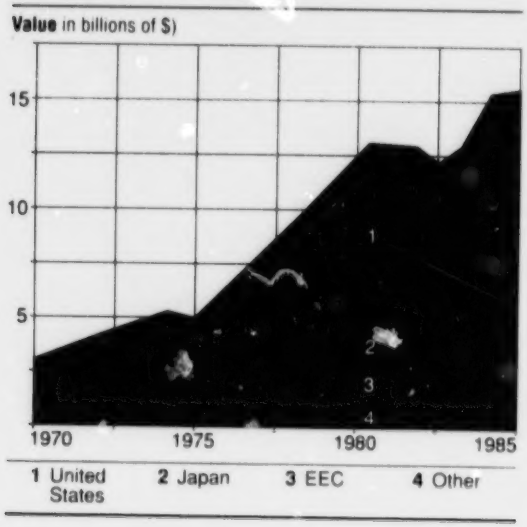
Value of Forest Industry to the Provincial Economies

Data are for 1986	Value of Forest Industries (estimated)	% of Gross Domestic Product[1]	Forest Industries as % of Manufactured Goods
Newfoundland/Labrador	$179,000 000	2.7	27
Prince Edward Island	4,000,000	0.9	4
Nova Scotia	368,000,000	3.2	17
New Brunswick	729,000,000	7.1	37
Quebec	4,808,000,000	4.2	17
Ontario	4,311,000,000	2.1	7
Manitoba	227,000,000	1.2	9
Saskatchewan	265 400 000	0.9	13
Alberta	530,000,000	1.0	8
British Columbia	5,341,000,000	8.2	53
Yukon	n/a[2]	n/a[2]	n/a[2]
Northwest Territories	n/a[2]	n/a[2]	n/a[2]
Canada	16,668,000,000	3.6	15

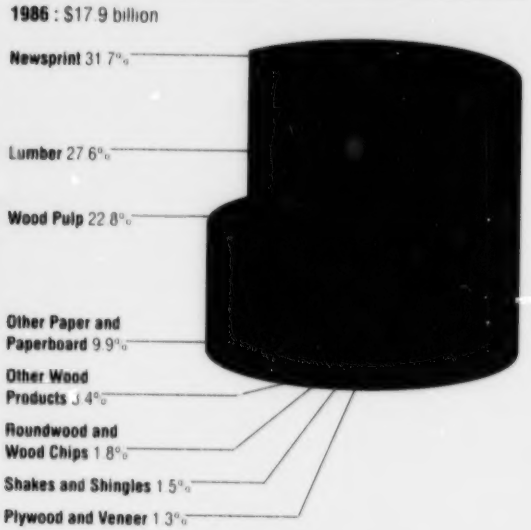
Caption:
The importance of the forest industry to each of the provincial economies varies across the country.

[1] The Gross Domestic Product measures the value of all the goods and services the Province (or Country) produces in a given year.
[2] Not available - When there are only one or two producers, these statistics are not provided.

Principal Destinations for Canadian Forest Products



Total Value of Exports



Caption:
Canada harvests primarily softwood species such as spruce, pine and balsam fir. About 165 million cubic metres of timber are harvested annually, about four-fifths of it from British Columbia, Quebec and Ontario combined. Each year, we ship roughly $30 billion worth of forest products; over half of that is in exports to countries around the world.

Forestry of the Future

Research underlies and fuels each step of the forest management cycle from planning through to harvesting and product development. It is essential to the success of management strategies. Research is carried out by the forest industry, provincial and federal governments, and universities. Often, projects are joint ventures in which topics reflect industrial priorities. Co-ordinated endeavours also help to avoid duplication of research efforts and funding.

Forest Management Planning

Computers continue to make inroads in forest management. Current efforts concentrate on developing better models to simulate forest conditions and the use of tools such as the Geographic Information System (GIS). GIS is a computer based planning and mapping system that allows foresters to rapidly enter, review and update multiple layers of forestry information. Its improved accuracy over manual systems permits planners to make more informed harvesting and silvicultural decisions.

Another research field — site classification — assesses forest stand information, soil, geology, climate, biology, topography and other environmental conditions for each site. This work pinpoints appropriate management techniques for improved success in silvicultural and other activities.

Silviculture

Biotechnology is a technique that uses living cells and organisms to make or modify products to improve plants and animals, or to manipulate micro-organisms for specific uses. In forestry, we are using biotechnology as a tool to produce large numbers of seedlings for planting, much faster than by the conventional seed and seedling methods. For example, we are trying to manipulate tree roots by giving them nitrogen-fixing bacteria to increase their survival and to make them grow faster. We have also developed a bacteriological insecticide (Bt), which kills insect larvae while not threatening the environment.

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Forest Protection

New fire suppressants such as retardant foam are being tested. Lightning forecasting and ground strike detection are the subjects of several studies.

Scientists concerned with insect control are developing environmentally acceptable insecticides. Aerial spray application technology is being improved. Researchers also are investigating alternate control methods such as breeding insect-tolerant tree species, and using natural insect predators.

Harvesting

Researchers have designed high flotation tires for use in environmentally sensitive areas. These tires reduce soil compaction and provide extra traction and machine stability.

Forest Products

Many provinces are researching new products. Manufacturers are testing tree species for new uses. Poplar and aspen are now being used as veneer and pulp material.

Wood currently provides about four per cent of Canada's primary energy requirements. This could reach 10 per cent by the year 2000. Wood residue from harvesting operations is an alternative to oil. The residue is chipped and used to fuel converted boiler units.

The wood ash left in these units is rich in nutrients. Harvested areas where entire trees (branches and all) were removed may suffer from a loss of nutrients normally supplied by decaying matter. Scientists are testing ways of returning the wood ash to the forest floor.

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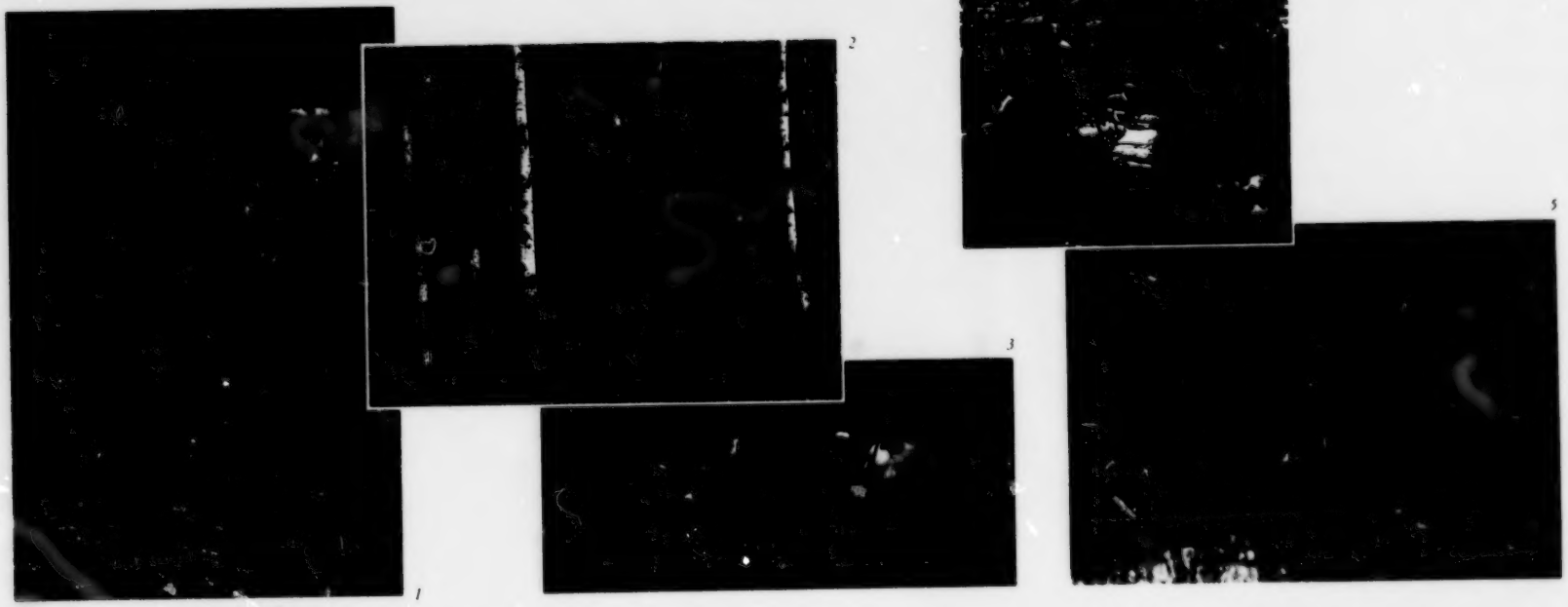
The Recreational Forest

If ever there was a time when Canadians needed the forests for retreat and seclusion, it is now. The country grows more urban by the decade, and daily life for many has become accordingly more hectic. Canadians and visiting tourists enter the forests to hike, fish, hunt and camp. Park space and outdoor recreation facilities are at a premium. The wilderness excursion business is booming. Never have our several hundred provincial and national parks seemed so precious.

Current forest management principles, as well as economic expediency, dictate the removal of mature trees once they achieve marketable size. The virgin forests and huge tree specimens recorded by 19th century pioneers are steadily disappearing. Thus, besides being natural sanctuaries, the national and provincial parks have come to function as tree museums.

In municipal parks, carefully tended urban trees serve both aesthetic and ecological purposes. They purify the air, shade parched lawns and retain groundwater. Many provinces have enacted programs to acknowledge trees of notable heritage, biological or other significance. Illustrated publications augment the programs to give the 'famous trees' some measure of protection.



Coincident with the increased recreational use of the wilderness has come the rising requirement for industrial wood. Simultaneously, urban and industrial expansion in places has threatened valuable wildlife habitats. These sometimes conflicting demands on our forest wealth — the industrial, the recreational and the ecological — make the balanced, multiple use aspect of forest planning essential.

At one extreme, forests can be viewed merely as the means to an industrial end. Conversely, they can be seen as ends in themselves: complex organisms that stood rooted on this planet millions of years before mankind thought to turn them into a 'means' for anything. Both viewpoints nevertheless require forest management as the method of preserving trees — for either purpose.

Canada's natural heritage is envied by much of the industrial world whose forests, ruined by earlier mismanagement, stand as mute testament to what awaits us if we fail to act responsibly now. Fortunately, we are learning from others' errors. Management commitments made today will ensure a healthy and productive forest inheritance for future generations.

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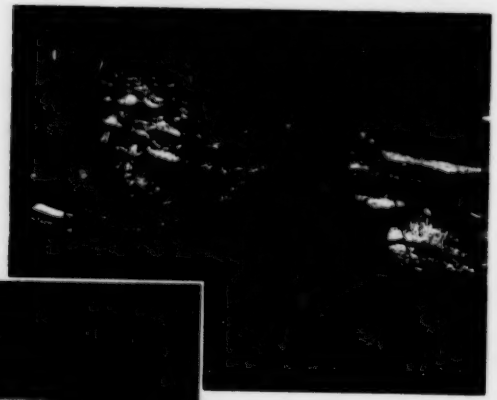

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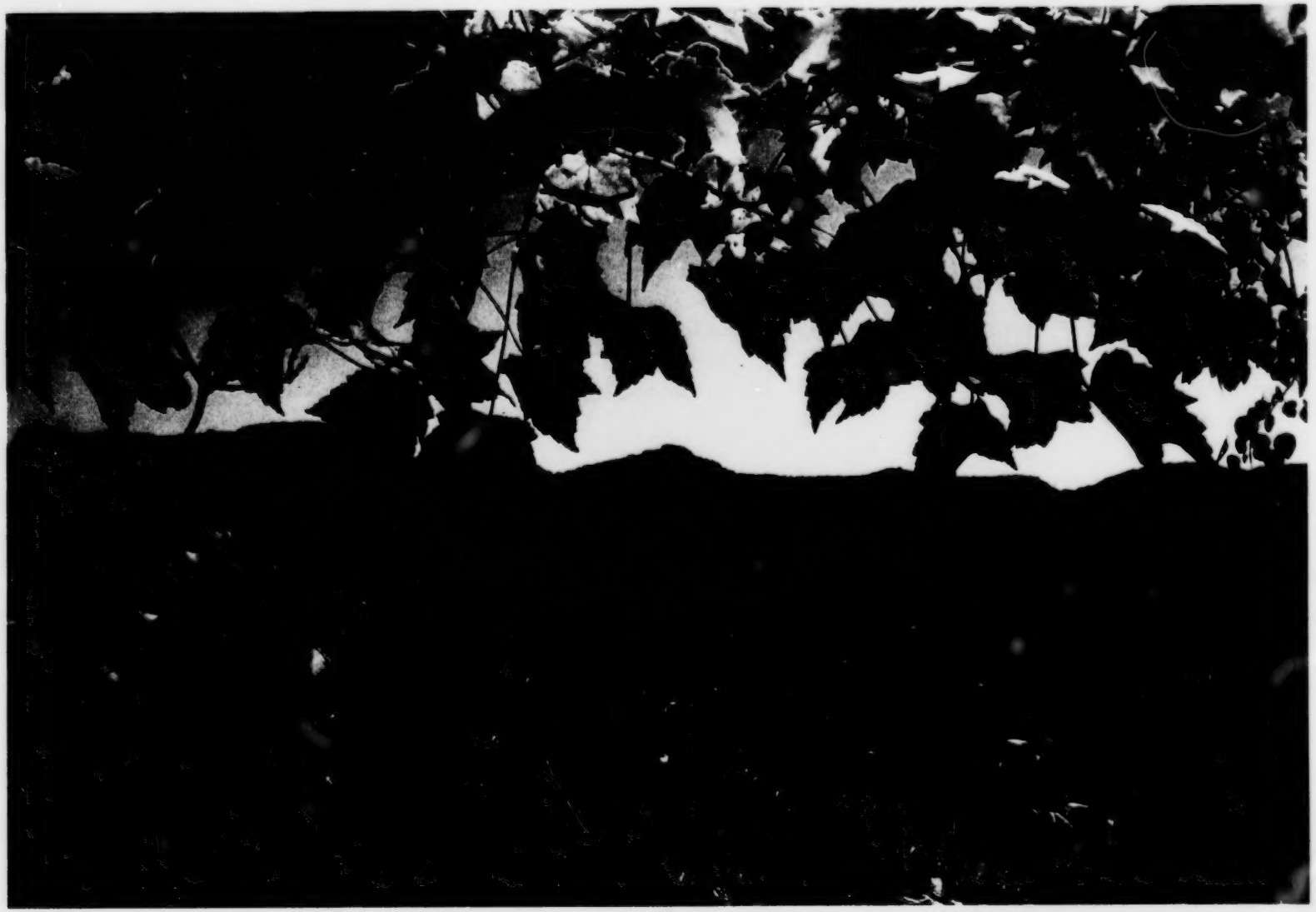

Appendix

Cover
Next to the Soviet Union, Canada has the largest softwood forest area on earth.
Alberta Forest Service

Title Page
Source of wood, or object of reverence? A Sitka spruce, Carmanah Creek on the British Columbia coast.
British Columbia Ministry of Forests

Trees, water, mist . . . Quetico Provincial Park, Ontario.
Ontario Ministry of Natural Resources

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Mixed evergreen and deciduous trees in autumn near Petawawa, Ontario.
Forestry Canada

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New Brunswick logdrivers of the early 1900s, working to break a log jam, pause for the photographer.
New Brunswick Provincial Archives

5-2
Canada's recently retired dollar bill depicts tugboats herding pulpwood on the Ottawa River beneath the Parliament Buildings.

5-3
View from Mount Royal, Montreal, Quebec.
Nova Scotia Department of Lands and Forests

The Living Tree, *6*
Illustration by Kelly Burke, Halifax, Nova Scotia

The Forest Community, *7*
Illustration by Kelly Burke, Halifax, Nova Scotia

Forests and the Ice Age, *8*
What most of Canada looked like at the close of the last great Ice Age: rock debris at the toe of the Saskatchewan Glacier, Alberta.
Newfoundland Department of Mines and Energy

Canada Forests Regions Map, *9*
Forest Zones Map: Adapted from ***Forest Regions of Canada***, Environment Canada, 1972

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10-1
Micmac salmon fishing camp on New Brunswick's Restigouche River, early 1900s. Long before Old World colonists arrived here, native peoples had developed a culture perfectly attuned to the world of forest, river and ocean.
Public Archives of Canada — 016436

10-2
Pine and oak timber rafts being readied for export on waiting ships, Quebec City, late 1850s.
Public Archives of Canada 6073

10-3
Looking like a nuclear submarine, this 181-metre-long chained bundle of 22,000 logs arrives safely in New York, August 11, 1888 after an 11-day voyage from Joggins, Nova Scotia.
Illustration from Scientific American, *courtesy N.S. Museum*

10-4
The woodcutters' basic tools in British Columbia up to World War II: crosscut saw (or "Swedish fiddle"), double-bitted axe (one blade for limbing, one for chopping) and the iron-shod springboard for standing on when felling Douglas-fir.
British Columbia Forestry Museum, Duncan, B.C.

11-1
Until year-round forest roads became feasible in the 1940s, loggers stayed in camps like these most of the winter. The most important person was the cook, here a woman.
Alberta Forest Service

11-2&3
Alexander Buntin built Canada's first groundwood pulp mill at Windsor Mills, P.Q. in 1866. Charles Fenerty, a Nova Scotian, co-invented the process some 20 years before.
Canadian Pulp and Paper Association, from Paper in the Making, *George Carruthers, 1947, Garden City Press Cooperative, Toronto*

11-4
Wood was the plastic of the 1800s. A great variety of machines were devised to shape everything from circular mouldings to window frames.
Appleton's Cyclopedia of Applied Mechanics, Vol. 2, 1880

11-5
Wealthy lumber barons of the 19th century often built ornate wooden mansions like this one in Windsor, Nova Scotia.
Nova Scotia Museum

11-6
"Putting in the undercut" with a two-man, 80kg Burnett powersaw, 1945. After World War II one-man power saws revolutionized logging.
HP81747 British Columbia Archives & Records Service

11-7
If you can't bring the logs to the mill, take the mill to the logs. In rural areas gasoline-powered "push-bench" sawmills like this have long been a local source of rough construction lumber.
Alberta Forest Service

A New Vision, *12*
This "digitized" view of New Brunswick mixed wood forest suggests the process whereby raw data from ground surveys and aerial photographs is translated by computer into a usable management tool.
New Brunswick Department of Natural Resources and Energy

Forest Management, *13*
13-1
What's the soil like here? Soil is the single most important factor in the life of a tree. Sampling gives forest managers important clues to the growth potential of a site.
Alberta Forest Service

13-2
If you take a branch tip or *scion* from a mature "plus tree" and graft it to a potted seedling of the same species, within a few years it will bear crops of superior seed.
Nova Scotia Department of Lands and Forests

13-3
In the humid Maritimes, natural restocking of cutovers with spruce and fir often creates thickets where growth stagnates due to crowding. To optimize growth, professional silviculture workers use spacing saws to remove all but 3,000 trees per hectare.
Nova Scotia Department of Lands and Forests

13-4
One way to start a new forest without planting is to harvest the stand in stages, leaving some mature trees to shelter and seed the ground. Once seedlings are established, the overstory is cut. This is called the shelterwood system.
Saskatchewan Parks and Renewable Resources

13-5
At sunrise on a windless morning near Parrsboro, Nova Scotia, pilots spray budworm-infested forests with Bt, a biological insecticide made from soil bacteria.
Nova Scotia Department of Lands and Forests

13-6
Knowing tree ages is basic to good forest management. This Swedish increment borer removes a core of wood for counting the annual rings without harming the tree.
Saskatchewan Parks and Renewable Resources

Planning Our Forestry Future, ***14***
14-1
For many, nothing is as soothing as canoeing on a wilderness lake. Legendary Canadian artist Tom Thomson may have paddled past this hillside in Algonquin Provincial Park.
Ontario Ministry of Natural Resources

14-2
In a Thunder Bay, Ontario greenhouse, thousands of grafted trees, all labelled by geographic origin, await planting. They will form a seed orchard where crops of superior seed will be harvested at a fraction of the usual cost.
Ontario Ministry of Natural Resources

Silviculture in Action, ***19-21***
19-1
Normally, female conifer "flowers" are fertilized by windborne male pollen. By excluding this random pollen and injecting pollen collected from "plus trees", scientists can upgrade seed quality.
British Columbia Ministry of Forests

19-2
A fast way to grow certain trees is by placing cuttings in the soil. This aspen cutting has taken root and will grow into a replica or clone of its parent.
Saskatchewan Parks and Renewable Resources

19-3
Pine Ridge Forest Nursery north of Edmonton supplies a large part of Alberta's planting stock.
Alberta Forest Service

19-4
Seedlings must be shaded from the hot summer sun.
Alberta Forest Service

20-1
Greenhouse at Strathlorne Forest Nursery, Cape Breton Island, Nova Scotia, full of newly seeded container trays.
Nova Scotia Department of Lands and Forests

(Insert)
Container seedlings flourish under controlled conditions of light, warmth, nutrients and water.
Nova Scotia Department of Lands and Forests

20-2
Container seedlings lend themselves to planting with tools like the Finnish pottiputki. Driving the point into the ground, the planter activates its "duckbill" to open a space in the earth, drops the seedling with its rootplug down the pipe, removes the tool and heels the tree firmly in.
Newfoundland Department of Forestry and Agriculture

20-3
Pottiputki planter.
Nova Scotia Department of Lands and Forests

20-4
Where organic matter or shrub competition prevent successful planting, bulldozers with special blades are used to loosen and mix the soil.
P.E.I. Department of Forestry and Energy

20-5
Young white spruce, Saskatchewan.
Saskatchewan Parks and Renewable Resources

21-1
Natural red spruce regeneration resulting from a shelterwood cutting in Nova Scotia. The system is excellent on smaller woodlands with species that thrive in partial shade.
Nova Scotia Department of Lands and Forests

21-2
Early thinning on good sites speeds tree growth dramatically.
Newfoundland Department of Forestry and Agriculture

21-3
Some species, like Jack pine, need fire to open their tightly sealed cones and release seeds to start a new forest on the scorched, weed-free ground.
Forestry Canada (Petawawa National Forest Institute)

Forest Protection, *22&23*
22-1
Occasional fire is natural in many forest ecosystems. Lightning fires have always occurred, and native peoples used fire to manage vegetation and game. But modern wildfires are mostly of human origin and very destructive.
Forestry Canada (Petawawa National Forest Institute)

22-2
A pillar of smoke near Halifax signals the start of a forest fire.
Nova Scotia Department of Lands and Forests

22-3
The most important element in modern fire fighting is instant communications. The fire control headquarters at Shubenacadie connects aircraft, vehicles, fire towers and ground crews. It also links RCMP, Emergency Measures Organizations and Lands and Forests conservation officers.
Nova Scotia Department of Lands and Forests

22-4
"Hit the fire while it's small!" is the motto of Nova Scotia's highly trained Helitak team. A member loads a portable fire pump into a Bell 212 helicopter waiting to whisk them to a fire.
Nova Scotia Department of Lands and Forests

23-1
This pine is being attacked by dwarf mistletoe, a parasitic plant.
Manitoba Department of Natural Resources

(Insert)
Western dwarf mistletoe.
Manitoba Department of Natural Resources

23-2
Late feeding stage of the spruce budworm on balsam fir twig.
New Brunswick Department of Natural Resources and Energy

23-3
The scorched appearance of the trees in the background is caused by the feeding of millions of small caterpillars, the larvae of the spruce budworm moth.
Manitoba Department of Natural Resources

23-4
The conks or spore-producing structures on this birch show that the tree is infected with fungi. Fungi help convert trees back into soil, but destroy much valuable wood in the process.
Nova Scotia Department of Lands and Forests

23-5
Voracious caterpillars like these can strip a tree of leaves in hours.
Manitoba Department of Natural Resources

Harvesting the Forest, *24&25*
24-1
Not all harvest sites need planting. In humid areas like coastal British Columbia and the Maritimes, many softwoods seed in naturally.
British Columbia Ministry of Forests

24-2
Selection cutting – harvesting mature trees singly or in small groups throughout a forest – works best with species that will germinate and grow in shade, like these red spruce.
Nova Scotia Department of Lands and Forests

24-3
The modern, well-equipped forest worker is a skilled professional who earns good money, is home every night, and is the mainstay of the forest industry.
Nova Scotia Department of Lands and Forests

24-4
On large operations in uniform, even-aged stands, clearcutting and planting are the preferred method. On such areas multi-purpose machines that fell, limb and buck the trees into desired lengths are commonly used.
Ontario Ministry of Natural Resources

25-1
A farm tractor equipped with a forestry winch makes an efficient rig for skidding logs to roadside in small woodlands, replacing the horse.
Nova Scotia Department of Lands and Forests

25-2
Before World War II, horses and oxen were the only means for moving logs to riverbank or roadside. Today, most larger forest operations use skidders to haul tree-length wood to the landing.
Nova Scotia Department of Lands and Forests

25-3
Energy Corporation chip pile, Parkdale, P.E.I. While progressive sawmill operators have long sold wood chips to pulp mills and used bark and sawdust for heating, only recently have wood residues become attractive commercially.
P.E.I. Department of Forestry and Energy

25-4
P.E.I. Home for the Aged, main unit in the downtown section of the Charlottetown District Heating System, which relies on wood residues.
P.E.I. Department of Forestry and Energy

The Productive Forest, *26-30*

26-1
The versatility of wood.
Nova Scotia Department of Government Services

26-2
Wooden church furnishings.
Nova Scotia Department of Government Services

26-3
Highly mechanized modern sawmills rely on computers to ensure optimum yield from each log—but sound human judgment is still essential.
British Columbia Ministry of Forests

26-4
Modern communications often rely on wood.
Nova Scotia Department of Government Services

26-5
The P.E.I. potato industry uses a lot of wooden crates.
P.E.I. Department of Forestry and Energy

26-6
Fencepost manufacturing, Saskatchewan.
Saskatchewan Parks and Renewable Resources

27-1
Firewood is popular for home heating.
P.E.I. Department of Forestry and Energy

27-2-4
More everyday wood products.
Nova Scotia Department of Government Services

28-1
Nova Scotia balsam fir Christmas trees ready for shipment to New England.
Nova Scotia Department of Lands and Forests

(Insert)
Sturdy wooden toys from Nova Scotia.
Nova Scotia Department of Government Services

28-2
Getting ready for the maple syrup season, a woodlot owner goes to inspect his trees. In Eastern Canada maple products represent an important seasonal industry; but acid precipitation is a looming threat.
Nova Scotia Department of Lands and Forests

28-3
Plastic taps and tubing are the preferred method of sap collection on larger operations.
Nova Scotia Department of Lands and Forests

28-4
Traditional sap collection.
Nova Scotia Department of Lands and Forests

Forestry of the Future, *31&32*

31-1
Satellite imagery is useful for monitoring forest change.
Saskatchewan Parks and Renewable Resources

31-2
Forest type maps are created by skilled interpreters working from aerial photographs and ground sample plot data.
Manitoba Department of Natural Resources

31-3
Modern forest inventories generate massive amounts of data which must be processed and analysed before it goes out of date. Each province runs its own inventory, usually on a 10-year cycle.
British Columbia Ministry of Forests

31-4
Digitizing map information for the Geographic Information System.
New Brunswick Department of Natural Resources and Energy

32-1
Canada is a world leader in forest fire control research and practice.
Ontario Ministry of Natural Resources

32-2
Main chip burner heating senior high and elementary schools, Montague, P.E.I.
P.E.I. Department of Forestry and Energy

32-3
Non-chemical insecticides like Bt look promising.
Nova Scotia Department of Lands and Forests

The Recreational Forest, 33-35

33-1
Fireweed graces Gravel River Nature Reserve, Ontario.
Ontario Ministry of Natural Resources

33-2
Aspen in the autumn.
Alberta Forest Service

33-3
Young and old enjoy a walk in the woods.
Saskatchewan Parks and Renewable Resources

33-4
In Rondeau Provincial Park, Ontario.
Ontario Ministry of Natural Resources

33-5
Millions of Canadians hunt for recreation and food. Seasons, bag limits and penalties ensure that wildlife stocks will not be depleted.
Nova Scotia Department of Lands and Forests

34-1
Beaver, Green Leaf Nature Reserve, Algonquin Park, Ontario. Wildlife conservation is inseparable from good forest management.
Ontario Ministry of Natural Resources

34-2
Conservation officer patrolling Green Water Park, Saskatchewan.
Saskatchewan Parks and Renewable Resources

34-3
Newfoundlanders have long enjoyed a close relationship with their woods and waters.
Newfoundland Department of Forestry and Agriculture

34-4
A place to think.
New Brunswick Department of Natural Resources and Energy

34-5
Springtime angling, Ontario.
Ontario Ministry of Natural Resources

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Autumn in Algoma, Ontario, a part of Canada made famous by Group of Seven painters like A.Y. Jackson.
Ontario Ministry of Natural Resources

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